Midwest Engineer

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MIDWEST ENGINEER

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Serving the Engineering Profession

September, 1950 CONTENTS Vol. 3, No. 1

COVER CREDIT

Our cover photo, showing traffic passing under the new Edens Superhighway, is by courtesy of the Cook County Highway Department. It illustrates the timely discussion which begins on Page 9, "Trucks—Do They Pay Their Fair Share of Highway Costs?"

September 16, Excursion

An excursion to Portland Cement's new Research laboratories in Skokie, will be held Saturday, September 16. Further details will be announced by postcard to members.

September 25, Industry's Survival

SPONSORED BY THE JUNIOR DIVISION

A top speaker and industrialist of wide experience, A. G. Bryant, president, Bryant Machinery and Engineering Company, will be the first speaker of the season, September 25, at the regular Monday night meeting of WSE.

Mr. Bryant's subject will be: "Industry's Survival in Another War."

He is a past president of the National Machine Tool Builders' Association and also is past president of the American Machine Tool Distributors' Association, having been the only man to have held both of these offices.

During the last war he served on the Advisory Committee of the War Production Board, and as advisor to several other war agencies in Washington.

Representing the machine tool industry, Mr. Bryant made a special survey in Europe of the effect of the recovery program with particular reference to industrial production. He went after consultation with Paul G. Hoffman and other officials of the ECA, and while abroad he inspected industrial plants, conferred with local industrialists and officials, and was asked to address meetings in London, Paris and the Hague.

For more than ten years he has served as a member of or as chairman of the Government Relations Committee of the Machine Tool Industry, and has been in personal conference throughout this period with Cabinet officials and leaders of Congress in presenting to the Government the position of industry during the war and post-war periods. He is currently involved in discussions with Washington officials concerning industry's responsibilities in the present emergency.

He is also vice-president of the Cleereman Machine Tool Company, Green Bay, Wisconsin.

Don't Forget That The WSE Dining Room And Lounge Are Ready To Serve You

What's New at WSE...

The Society's organization for the current year has been completed and is functioning. The various sections' Executive Committees have been elected and have named their officers. All committee chairmen have been appointed and have either completed or are in process of naming the personnel of their respective committees. The Program Committee has, in cooperation with the various sections, agreed upon scheduled dates for meetings throughout the fiscal year.

The Society's budget is in good shape. Last year's operation was carried out with an excess of revenues over expenditures, and this year's budget is projected on a similar balanced basis. Payments of dues for the current fiscal year have been received on a very satisfactory basis. The auditoriums are being dated up rapidly.

Two items of major importance in our estimated revenues for this year and in which all members are urged to assist, are the securing of new members and of advertising in the Midwest Engineer and in the Year Book which will be issued as part II of the November issue. Each member is urged to cooperate in these two activities and the chairmen of the respective committees will appreciate your help.

An Affiliate Agreement has been signed with the Architect's Club of Chicago, under which the Society will render office services to the latter and under which the individual members of the Architect's Club will participate in the general use of the headquarters.

We believe it is an element of strength that the Society is composed of representatives from all the engineering professions; that the membership represents hundreds of separate businesses; and that it constitutes a complete cross-section of engineering and scientific activities of the community. At the same time it is recognized that the resulting diverse interests of our members result in a most difficult administrative task to carry out a well-balanced program which members will generally feel has been worthwhile to them individually.

The Board of Direction, Officers, and various chairmen of sections and committees are most anxious to have the program of the Society continually improve. All of us will welcome suggestions for improvements in our program and sincerely hope that members will not only take part in the Society's activities as now organized, but will submit ideas for expanded or improved services which the Society may properly undertake. We will exert every effort to make each Monday night's program during this fiscal year interesting and present it with careful attention to those important details, such as starting on time, having proper mechanical aids where necessary as part of the presentation, etc.

The headquarters has been redecorated and is now ready for the fall and winter activities. You are encouraged to make use of the dining room and lounge facilities.

Mr. Harrington and the office staff will welcome your requests for service which the Society may furnish to you.

H. P. Sedwick
President

Technical Knowledge is not enough

by James D. Cunningham (WSE)
President, Republic Flow Meters, Co.

Presented on the occasion of his acceptance of the C.T.S.C. Merit Award, May 9, 1950

We technical men might be regarded as the most fortunate group in the world's history. We are the technical leaders of a great technical center in a nation which has won its way to world supremacy by technical mastery of its natural resources. This power over natural wealth and human destiny would have been the envy of the kings and emperors of a few hundred years ago. Even Alexander, who conquered and ruled the greater part of the civilized world of his time, would have stood in awe of the forces that you and I release a dozen times a day as we make mere routine decisions. Surely at this pinnacle of technical power in a mechanized civilization, we must be the happiest men and women the world has ever seen!

The fact is, of course, that we are nothing of the kind. Instead, we are confused and apprehensive. Many of us look backward with longing to a time when we were much less powerful but more serene, and wish we could turn the clock back to that simpler, happier day. Most of us look forward fearfully to a future that is dark with bewilderment, doubt and possibilities for catastrophe. The few of us who do see, or think we see, a way out of our present difficulties, know in our hearts that there is little likelihood of that way being followed. I was amused in looking over a calendar of special days and weeks issued by the U. S. Department of Commerce to note a juxtaposition of events that seemed to me to sum up our situation with a sort of desperate humor. The calendar showed American Armed Forces Day coming right in the middle of National Pickle Week! It couldn't be said quicker!

As we contemplate the vast social and political complexity of the world today, it has become commonplace for us to say "Isn't it a tragedy? We have concentrated our talents on technical problems to the neglect of human problems." But for most of us this is just an expression, not a real belief. We don't really think it is a tragedy at all, because we keep right on concentrating on technical problems and neglecting human problems—in our individual lives, in our businesses and professions, and in our communities. We may brood about politics and public problems but we don't do anything about them. Mostly, we see them as a somber backdrop for our own individual triumphs of technique. We think that if everybody else were as brilliant and energetic as we are, the problems would be solved.

Perhaps this is a natural attitude for us to take. To each of us his own work, his own interest, is the most important thing in the world. As technical people, we are bound to look upon technical progress as an important objective of human activity. But eventually we come to the questions that many of us keep asking ourselves more and more frequently these days—the questions I'd like to discuss with you here tonight: Is technical progress enough? Does it justify our activity? If not, what are the other ends or objectives we should seek?

Of course, these are not new questions. Since the beginning of our civilization men have asked themselves these very same questions. The French philosopher, Rousseau, for example, put the question in a different, and challenging, form. He asked: "Has the progress of science done man any real good?" Obviously, we think the answer is "Yes!" and yet it may be worth-while for us to examine the answer that Rousseau himself formulated. He was skeptical. In his Discourse on the Arts and Sciences, Rousseau recalled the words of Socrates: "Because the most skillful of

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Technical Education Is Not Enough

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men excel others in their particular jobs, they think themselves wiser than all the rest of mankind; this arrogance spoils all their skill in my eyes." In Rousseau's judgment, the normal effects of science may have been so bad as to offset its physical advantages.

These are harsh words, and I doubt that many of us would acknowledge that they are true. But certainly it is a fact that skillful men are likely to become self-centered, and certainly this fact has something to do with the political and social difficulties in which we find ourselves today.

But there is another, and more important, respect in which our technical and moral interests are in conflict. I think it is fair to say that a large part of the technical mastery that we have achieved in this country has been the direct result of competition. It is their efforts to excel one another and so achieve recognition and rewards, that take men to the top within a profession or business, and it is the effort to excel and profit that takes a company ahead within an industry, and an industry ahead in society. Our customs and laws recognize the value of competition and seek to preserve it. Yet the emphasis on competition in our economic lives is in partial conflict with the moral rules by which our personal lives are governed.

Plainly, the pressures of technical progress have forced us to abandon many moral doctrines which we profess to believe. Is this the inevitable scourge of our efforts to conquer our environment, as Rousseau believed? Or is it rather the result of a competitive, technical interest that has become so intense that we have lost sight of other values? And can we now, by educating ourselves and our children, achieve the kind of balance of technical and spiritual forces that is essential to our happiness, if not to our survival?

I think it is encouraging that we have recognized the need and are making the effort. Let me present some of the evidence: Our engineering and technical faculties are awakening more and more to the need for humanizing the technical curriculum. What may be more significant, students themselves, in contrast to their attitude of just a few years ago, are welcoming and even demanding courses outside their chosen technical fields. Here, for example, is a recent statement by Dean Paul Hemke of Rensselaer Polytechnic Institute: "The engineer and scientist as a professional man deals with people as much as he deals with things. Because of his profession, he has additional responsibilities as a citizen. The broader and more understanding his outlook upon the world, the better able he is to perform his duties as a citizen, and the fuller and more complete will be his life as a human being."

Dean Hemke's views are echoed in technical and professional schools throughout the country. In a recent survey, the education editor of the *New York Times* found only an occasional engineering student who felt he was wasting time on language, history and literature courses. By and large, the *Times* found, science and engineering students want the broadest possible non-technical education. They are trying to squeeze into their already crowded schedules as many liberal arts courses as they are permitted to. At Georgia Tech this year, for example, more than 10 per cent of the entire student body has voluntarily scheduled modern language courses as electives. Many liberal arts classes for juniors and seniors have no room for all the students who wish to take them!

Here is a confirming report from Dr. Weller Embler of Cooper Union: "It has been our experience," he said, "that technical students are not only willing, but very often eager, to read, think and talk about humanities—especially ideals and problems. If there remains any displeasure on their part at being required to take humanities courses, the displeasure stems largely from the fact that they are too busy with technical studies to give proper time and thought to the humanities courses." Contrast that with your own experience as a technical student!

The reasoning behind these changes reflects the changing emphasis in our technical society—the awakening realization that technical know-how is not enough. The dean of engineering at Yale University, Dr. Walter Wohlenberg, summed it up recently in these words: "The Liberal arts are a part of the cultural and educational background of the human race, as much as engineering and science are. The problems of modern society stem from the whole of human experience; to understand and help in their solution requires a broad educational background."

Perhaps the students of this changing emphasis in technical education are likely to be less keen as technical specialists than their predecessors have been but maybe our hope for the future is based on the expectation that they may be more keen as citizens and as human beings. As specialists, many of you may resent the implication here that you have been less than you might have been as citizens and human beings. Look what you have contributed to human comfort and well-being through your technical accomplishments! Look at the number of people you employ, and the taxes you pay, and the civic contributions you make! What is expected of a citizen and a human being that you haven't given? You may well ask, and it is a fair question.

As I see it, the answer to your question is related to the answer that I think we must give to Rousseau's question, "Has the progress of science done man any real good?" If science has simply made man more comfortable, if it has made him only stronger and sleeker, or even healthier—it has not improved him intrinsically at all, but we have done all that could be expected of us as human beings. However, if science has released man from the demands of animal existence so that he may turn his energies toward moral and spiritual improvement —then the possibilities are as great as the accomplishments to date are small, and many of us have failed in our chief responsibility as citizens and human beings.

Is this just so much Sunday School talk, without any real meaning in a world of H-bombs, public debts and ward committeemen?

I don't believe it is. In fact, I think it can be shown that our failure to recognize and respond to our broad responsibilities as citizens and human beings, our failure to understand that technical progress is not enough, is the key

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Can you write a prize paper?

ENTER THE NEW PRIZE PAPER COMPETITION SPONSORED BY W.S.E. FOR ALL MEMBERS

CONTEST CLOSES APRIL 1, 1951

Here are the rules:

1. Any member of Society may compete regardless of grade of membership.
2. Papers shall not be highly technical in nature. A clear, concise and interesting coverage is desired rather than complex formulae or derivations. The subject discussed should be of general interest to engineers but should not be of a political or highly controversial nature.
3. All members of the Society who wish to submit papers in this contest should contact the Secretary as early as possible and not later than February 1, 1951, and request a copy of the rules governing the competition and an outline of the minimum requirements for acceptance of papers. These cover in detail the mechanical make-up which should be followed in preparing and submitting papers for the contest.
4. Papers must be submitted to the Secretary for acceptance by April 1, 1951. If the Secretary finds that they meet the minimum requirements of the contest, he will forward them to the Awards Committee for review. The papers will be identified by number only. The Secretary of the Society is the only person who will maintain the key to the authors.
   If any paper does not comply with such minimum requirements, the Secretary will so advise the author and discuss with him the points which are below the minimum requirements. The papers which are accepted will be forwarded to the Awards Committee for judging not later than May 1, 1951. Papers which have not met the minimum requirements by that time cannot be considered for prizes.
5. Papers which are accepted will be judged on originality of presentation, editorial merit and value to the engineering profession.
6. The papers submitted must not have been previously published in substantially the same form. No copyrighted materials shall be used unless permission has been obtained and so indicated. All manuscripts, drawings, etc. are to become the property of the Society and cannot be published without the consent of the Society.
7. If the papers submitted are *not* of sufficient merit to warrant the award of any or all of the prizes, the Awards Committee reserves the right to award less than the three established prizes or to postpone the competition.
8. The winners will be announced and the prizes presented at the annual meeting of the Society in June, 1951.

Some of the minimum requirements:

(A copy of these requirements will be forwarded to each person who indicates desire to participate in the contest.)

1. The papers should be typewritten, double-spaced on 8½ x 11″ bond paper.
2. All copies of the written material and drawings or charts must be legible.
3. The paper should be bound in a flexible paper-back binder, the binding to be on the left-hand side.
4. The typing should be on one side of the page only.
5. All pages must be numbered.
6. A fly sheet should be included, giving the title only. The author's name should not appear on the paper.
7. All drawings, charts, exhibits, etc. should be lettered or numbered, reduced to either 8½ x 11″ or 11 x 16″ in size and bound with the paper.
8. The paper should be of at least 2,000 words in length and should not exceed 3,000 words.
9. The paper should not be highly technical in nature, and it should not discuss a political or highly controversial subject.
10. The paper should be written in the third person. Its make-up should be neat, the subject matter clear and the ideas well-expressed.

NOTIFY THE WSE EXECUTIVE SECRETARY OF YOUR INTEREST AND REQUEST COMPLETE RULES

First Prize

IN WSE'S 1950 TECHNICAL PAPER CONTEST

Measuring Circulating Water Flow By the Salt-Velocity Method

C. J. McLean, General Hydraulic Engineer, Public Service Company of Northern Illinois

It is not a simple problem to measure 150,000 gallons of water per minute. A recently completed steam-electric generating station required this quantity of water for condensing purposes. It became necessary to measure the flow, and no metering facilities were provided. After an investigation the decision was made to use the salt-velocity method. In order to apply this method at the station it was necessary to develop some new types of apparatus and to make some new applications of available electrical measuring instruments. Other engineers engaged in water measurements may be interested in the apparatus developed and the methods employed.

Earlier Applications

The salt-velocity method of water measurement has been used successfully for a number of years. In 1923 Charles M. Allen and Edwin A. Taylor presented a paper at the Annual Meeting of the American Society of Mechanical Engineers which described the results of a series of laboratory and commercial experiments they had conducted during the years 1921 to 1923 inclusive.

The theory of their method is based on the fact that salt increases the electrical conductivity of water. A salt solution is introduced at the upstream end of a conduit and the passage of this solution across one or more pairs of electrodes is recorded graphically by electrical recording instruments. The time required for the salt solution to pass between a pair of electrodes is accurately timed and the volume of the conduit between the same points is accurately determined. The flow in cubic feet per second is found by dividing the volume in cubic feet by the time in seconds.

The authors first used the salt-velocity method at the Alden Hydraulic Laboratory of the Worcester Polytechnic Institute, Worcester, Massachusetts. The apparatus and methods used during the first group of tests were very simple. In the first tests the raw salt was injected directly into the penstock. The operator punched a stop watch and then ran down the road to the laboratory where the ammeter was connected to the electrodes and he again punched the watch on observing the deflection of the meter needle. As the tests proceeded, the method of introducing the salt was continuously improved until finally it was accomplished by injecting the salt solution with a two-inch pipe from an elevated mixing tank. The flow of the solution was controlled by a two-inch quick-opening valve.

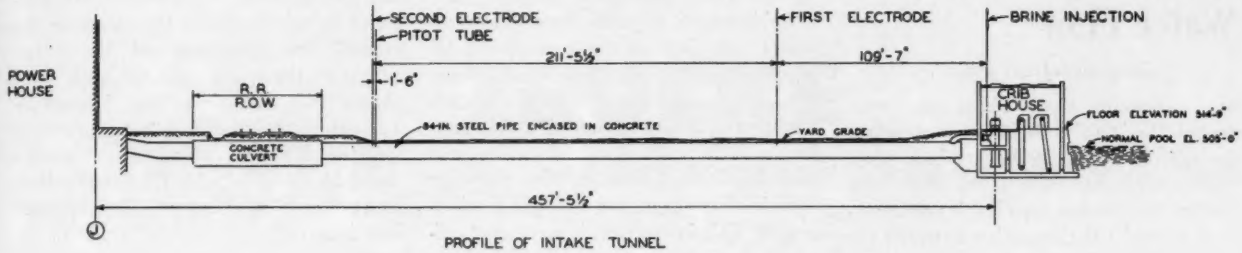
In the early tests copper electrodes at the end of a rod entered the 40-inch pipe line through a stuffing box, and the meters used on the 110-volt direct current circuits were indicating voltmeters and ammeters. In later tests the technique was improved by starting and stopping the watches on verbal signals transmitted by telephone. This eliminated the running from one station to the other. In order to check the results, 10-foot weir at the lower end of the laboratory was also used to measure the water.

In spite of the rather simple apparatus and the possibilities of errors due to the human equation, these early experiments produced surprisingly accurate results. The following is taken from the conclusions written by the authors of this first report:

> "These first laboratory tests showed conclusively that the tests could be made and repeated indefinitely with consistent results. It showed an apparently constant relation between the initial appearance of the salt at the electrodes and the time of maximum density of the salt passing the electrodes. When properly computed, the discharge by the salt-velocity method checked the true flow by weir within about one per cent for single runs and much closer for a long series of runs."

This method was later applied to tests of hydro-electric power units in New Hampshire and Canada. Improvements were made in the method of storing and injecting the brine into the water stream, and new types of electrodes were developed. Bristol direct-current recording ammeters with multiple pens were also used. One pen was connected to each electrode and a third was wired to a standard seconds-pendulum clock. This newer apparatus when checked in the laboratory against the standard 10 foot weir indicated an accuracy within .32 per cent, and the field results obtained were also quite accurate.

In 1932 the method was applied to measurements of the flow in some of the water tunnels in the city of Chicago. Check runs, where the Venturi meters were available, indicated accuracies within two per cent. In the Chicago tests many different problems were encountered. The tunnels were deep below the city, and the points where the tun-



PROFILE OF INTAKE TUNNEL

nels could be reached were far apart. The salt charges were placed by wiring six #8 mercury fulminate caps along the bottom seam on the inside of a 100 lb. bag of salt. The bag was lowered into the tunnel and when the test was ready the caps were fired electrically. The timing was by stop watches, and when the brine solution reached the electrode several thousand feet down the tunnel, the change in conductivity was indicated on a millivoltmeter.

Many other laboratory tests and field experiments have been made using this salt-velocity method, all of which confirm its accuracy as a device for measuring the volume of flowing water.

Location of Present Test

The new steam-electric generating unit referred to utilizes river water which at this point is a mixture of the natural river flow with the effluent from sanitary treatment plants and water diverted from Lake Michigan to the Illinois watershed. The crib house in which the circulating water pumps are installed is located on the deep water navigation channel, and is over 400 feet from the generating station. Water is delivered from the pumps through 60-inch steel pipes which join an 84-inch pipeline just outside the crib house building. (See Profile of Intake Tunnel on this page.) From this point to the station, approximately 417 feet, the water flows through a straight 84-inch O.D. steel pipe encased in concrete. Before entering the condenser, the line divides into two 60-inch lines which deliver the water to the two passes of the condenser. There are two 60-inch butterfly valves on the inlet and discharge sides of the condenser which are operated simultaneously through an interlocking linkage. It is possible with these valves to reverse the flow of water through the condenser for backwashing. After leaving the condenser, the water flows through two 60-inch steel pipes to the seal well. The water flows from the seal well back to the river through an 84-inch diameter discharge pipe.

Apparatus Developed

A study of the experiments of others indicated that the salt or brine solution should be forced into the moving stream of water as rapidly as possible. The pressure-vessel type of installation as used by Allen and Taylor, appeared to be the best method to be used in these tests. The discharge outlet from each of the two 48-inch pumps expands to a 60-inch steel pipe section. Outside the crib house these 60-inch pipes join the 84-inch pipeline which extends on a level grade to the generating station.

The brine solution was mixed and stored in a 50-gallon drum which was placed on a platform elevated about five feet above the crib house floor. For convenience there was a valve and hose connection at the bottom of the drum for filling the pressure cylinder. The pressure cylinder was made from a section of eight-inch steel pipe about four feet long and was fitted at the bottom with a four-inch flange-type quick-opening valve and also a one-inch valve for draining. At the top there was a two-inch opening with a gate valve for filling and a ¾-inch pipe connection with a pressure gauge for admitting compressed air. The same cylinder was used for tests on both pumps.

A standard four-inch flange-type gate valve with short nipple had been permanently connected to the discharge of each pump just ahead of the 60-inch pipe section. The change of the cylinder from one pump to the other was therefore made with a minimum delay.

The electrodes used were made of round bakelite cores with brass bands spaced ½-inch apart. This type of electrode had been used successfully in the Chicago water tunnel tests. The electrodes were attached to the bottom end of a one-inch black pipe about nine feet long. This pipe served as a holder to facilitate the placing of the electrode in the circulating water pipe at the proper position. A brass ferrule attached to the top of the bakelite core was threaded for attachment to internal threads prepared in the one-inch pipe. All fittings had to be within the diameter of a standard one-inch pipe as the electrode and pipe had to be passed through a stuffing box made from a section of 1¼-inch pipe with a brass compression ring at the top.

The entry into the 84-inch pipe was through two-inch nipples welded to the steel shell. These nipples were normally closed with two-inch standard gate valves. The stuffing box was fitted above the valves. The first location for the electrode was 109'-7" downstream from the point where the brine was admitted. The spacing between the electrodes was 211'-5½". The electrodes were first attached to the lower ends of the pipes and the electrical connections made. The pipe and electrode were then entered into the stuffing box chamber above the two-inch gate valve. The valve was then opened and the electrode forced into the stream of water to the desired position just above the center of the 84-inch pipe. The brass compression ring was then tightened to hold the pipe in position and to stop the leakage.

Two types of electrodes were successfully used. The first type, with two brass bands fixed ½-inch apart, had two wires through a hole in the center

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Measuring Circulating Water Flow

(*Continued from Page* 7)

of the bakelite core. These were connected to two rubber-covered wires brought down inside the one-inch pipe. The connections were taped with both rubber and friction tape but it was necessary to seal the connection between the pipe and the electrode to exclude water from inside the pipe to prevent short circuits. The electrode was used successfully, but some trouble was experienced with short circuits.

An improved electrode was built and used on later tests, which utilized the brass ferrule at the top of the electrode as one contact, with the pipe as the grounded conductor. The other contact was a brass cap at the bottom of the bakelite core. The rubber-covered wire was connected directly to it. No trouble with short circuits was experienced with this electrode. As a further improvement, a threaded ring was placed on the lower brass cap which made it possible to vary the spacing between the brass contact bands. Tests were run on one pump with the contact rings spaced ¼-inch apart with good success.

Rubber-covered wire from the electrodes were laid on the ground and all connections were run to a central location in the crib house where the recording apparatus was set up. A power supply of 120 volts A.C. 60 cycles was available at this location. The recorder used in these tests was a Brush Oscillograph. This instrument is somewhat different than those reported to have been used in previous applications of this method of testing. It is a high-speed strip-chart recording device. There are three chart speeds available in the instrument which are as follows:

Slow speed	5 mm. per second
Intermediate speed	25 mm. per second
High speed	125 mm. per second

The pen graphically recorded the relative amounts of current passing between the contacts on the electrodes. The exact amount of the current was not important. The time of a change in conductivity was important, however. The current used was A.C., therefore the form of the curve was a 60-cycle sine wave, and the cycles could be counted at the highest chart speed. At the lower speeds, however, the individual cycles could not be distinguished. Changes in the conductivity of the water increased or decreased the amplitude of the curve drawn by the pen. While the high-speed charts produced some very interesting records in the preliminary test runs, it was found that quite satisfactory results could be obtained with the intermediate chart speeds and the calculations were less involved.

Because of its source, the water at this point on the Des Plaines River has quite a high conductivity, therefore the Brush oscillograph was connected through a Wheatstone bridge. It was possible with this arrangement to balance out the normal conductivity until the pen recorded a very narrow band. It was possible in this manner to obtain observable changes in conductivity with low brine concentrations.

Method of Making Tests

During the tests the strip chart was started simultaneously with the injection of the brine solution. At a signal a charge of approximately three gallons of brine was forced into the circulating

(*Continued on Page* 19)

TABULATION OF DATA FROM FLOW MEASUREMENTS BY THE SALT VELOCITY METHOD

Test No.	Observed Travel Time Between Electrodes Seconds	Calculated Velocity Ft. per Sec.	Calculated Volume of Flow Gal. per Min.	Average Flow Gal. per Min.	Variation From The Average Percent	Measured Pumping Head Feet	Estimated Volume Pump Designed To Deliver To The System Gal. per Min.	Variation of Average Calculated Flow From Estimated Flow Percent
1	50.90	4.15	70,389		— .24			
2	51.24	4.13	70,050	70,559	— .72	23.17	72,000	—1.96
3	50.37	4.20	71,237		+ .95			
4	46.59	4.54	77,004		— .80			
5	46.12	4.58	77,683	77,626	+ .07	19.89	76,800	+1.08
6	45.83	4.61	78,192		+ .73			
7	44.86	4.71	79,888		+1.36			
8	46.01	4.60	78,022	78,814	—1.01	18.36	78,800	+ .02
9	45.71	4.63	78,531		— .36			
10	24.0	8.81	149,458		—1.27			
11	23.5	9.00	152,682	151,381	+ .86	22.40	147,000*	+3.00
12	23.6	8.96	152,003		+ .41			
13	23.43	9.03	153,198	153,198**				

* This figure calculated by adding estimated pump delivery for each pump at the measured head. This may not be a true figure and is included for comparative purposes only. The pumps were apparently delivering something in excess of the estimated combined capacities.

** This was a single run made during preliminary tests. No other runs were made at the same time for comparison.

TRUCKS

do they pay their fair share of highway costs?

excerpts from a discussion before the Western Society of Engineers, May 8, 1950

THE CASE FOR THE TRUCKS

Chester G. Moore, Chairman of the Board
Central Motor Freight Association, Inc.

To avoid thinking in terms of remotely related or completely extraneous matters, I think we should keep in mind that the question for consideration here today is: "Cost of highways: do commercial users pay their fair share?"

It is extremely difficult for a layman to evaluate accurately and to reconcile the conflicting statements which have been and continue to be made on this subject.

There are reasons for this confusion. One of the reasons is the fact that the processes involved in an accurate and scientific approach to the question are highly complicated and technical, and the reports, therefore, extremely long.

Therefore, public utterances on the subject from both sides frequently deal with generalities or specific instances which are inconclusive.

Another factor in the controversy which has served to confuse the public is the practice of quoting statements by anyone and everyone who, for one reason or another, sees fit to express an opinion. It has become particularly popular to express anti-truck opinions.

One handicap we face in this controversy is the fact that the trucking industry is made up of many small businesses which have few, if any, direct ties with influential large businesses.

On the other hand, there are numerous large and influential corporations which have substantial financial interests in the railroads . . . and who can and sometimes do speak out against trucks or in favor of railroads.

I suppose you are wondering what all this has to do with the question of whether the trucking industry pays its fair share of the cost of highways.

It has very little to do with it, and that is precisely the point I am trying to make. Most of what the public reads and hears on the subject is absolutely inconclusive. Some of

(*Continued on Page* 10)

THE CASE AGAINST THE TRUCKS

Col. John W. Wheeler, Executive Assistant
Chicago, Burlington and Quincy Railroad

In this discussion on the question, "Are the trucking companies paying a fair share of highway construction and maintenance costs?" I have been assigned to take the case against the trucks. Mr. Chester G. Moore will take the case for the trucks. Why we were chosen to do the job is at least partially evident in that Mr. Moore is paid by the trucking industry and I am paid by the railroad industry. We are flying our true colors from the masthead.

I regret the subject refers generally to highway trucking companies, because such could include diaper trucks, bread trucks, newspaper trucks, and many light and medium weight types of service trucks. In taking the position given me, I will confine my remarks to the heavy trucks with 18,000 lb. axle loads, and 55,000 lb. (or heavier) gross loads. The heavily loaded, long distance truck is not paying its share of road costs, because it destroys the highways.

Although I spent my years until 1937 a a highway engineer, and still feel I am competent as such, I realize that you as engineers are more apt to be convinced on highway matters by engineers still in highway practice and on the highway payroll, than by one in the employ of the railroad industry.

Please remember my accusation, namely, heavy trucks are not paying their share because of the terrific damage they do to our highways. Who says heavy trucks damage highways?

Mr. C. M. Hathaway, Chief Highway Engineer, Illinois Division of Highways, disclosed on Nov. 19th, 1949, in the Springfield State Journal, that a road comparison survey demonstrated a widespread destruction of Illinois highways wrought by heavy truck traffic. Hathaway accumulated detailed data on two sections of Illinois highway, thirty miles

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it has a partial bearing on the issue. Some of it has absolutely no relation to the issue. Some of it is based upon premises which are, to say the least, highly debatable. Some of it is cleverly misleading.

Back in 1931, the Interstate Commerce Commission, taking official notice of continual complaints by the railroads, recommended to Congress that an unbiased study be made by the Federal Government of the entire issue of transportation subsidy.

Following this recommendation Congress, in 1933, established the office of Federal Coordinator of Transportation, and the man named to head this office was Joseph B. Eastman, who launched an extensive study of the whole question.

Before he died, Joseph B. Eastman generally was recognized as this country's outstanding transportation expert. He had great knowledge, he had no axes to grind, and he was a political independent.

In addition to serving as Federal Coordinator of Transportation, he served on the bench of the Interstate Commerce Commission for 25 years. During World War II he was named by the president to head the Office of Defense Transportation, a post he held at the time of his death.

The Eastman study set out to determine the answers to the same two fundamental questions which confront anyone who attempts a really scientific study.

These questions are:

1. Do motor vehicle owners, as an entire group, pay their share of the cost of highways and streets?

2. If they do, then do the owners of the various types of motor vehicles pay their fair share of that portion of the cost which is assignable to motor vehicle owners as a whole?

It is an accepted principle that motor vehicle owners cannot properly be charged with the entire cost of every highway, road and street in the United States.

The cost of access streets to our homes and the cost of all similar access roads and streets throughout the country, shows up in the over-all cost of American highways and streets. Obviously, such costs must be eliminated in any attempt to determine the portion of total highway and street costs which are chargeable to the motoring public generally.

Moreover, the people of the nation as a whole, whether they own motor vehicles or not, need and benefit from highways from the standpoint of national defense and the post road system. That is why the Federal Government, since 1916, has taken some of the money paid in general taxes and given it back to the states in the form of Federal-aid highway funds.

So the first question is determination of what share of total highway and street costs properly is chargeable to motor vehicle owners as an over-all group. . . One's judgment on this phase of the matter alone, whether it be objective or biased, can make the difference between a conclusion that motor vehicle owners are subsidized or pay more than their fair share.

The net result of the Eastman study was a conclusion that in the period studied, 1921 through 1937, motor vehicle owners HAD paid their fair share of highway and street costs, and actually had over-paid to the tune of $385,360,000.

The second phase of the study was determination of whether different types of motor vehicles had paid their fair share of that portion of road and street costs which properly was assignable to motor vehicle owners as a whole.

The first step was a scientific determination of what type of roads would be necessary if there were no large and heavy vehicles, and roads had to be built only to withstand the elements and carry light passenger car traffic.

Such a road generally is referred to as a "basic" road.

Once the cost of the "basic" road was determined, the cost of such road was assigned equally among all motor vehicles on the basis of mileage operated.

The difference in the cost of the "basic" road and the cost of the surfaces which actually were being built was assigned entirely to the heavier vehicles which, theoretically at least, were responsible for this added cost.

When the cost assignable to different groups of motor vehicles had thus been determined, such costs were compared with the special tax payments which had been made by the comparable groups of motor vehicles.

The conclusion was that the payments made by passenger cars approximated their cost responsibility, and that most of the heavier vehicle groups, particularly the heaviest trucks, had paid substantially more than their assigned share.

Thus, on the basis of this complete, comprehensive and unbiased study by an agency of the Federal Government, the answer to the question before us is an emphatic "YES, commercial motor vehicles do pay their fair share of highway costs."

It is totally inadequate for those who would like to ignore the Eastman report to kiss it off by saying it is 10 years old. For if the same principles and same methods were applied to figures for the intervening years, the results unquestionably would be about the same.

The Eastman study is not the only study that is available on the subject, but from the standpoint of soundness and objectivity we are confident that it stacks up well against any of the others that have been made.

Another study of interest, entitled "Highway Costs," was published by the Association of American Railroads in 1939. In fact, I believe it was designed as an answer to the Eastman report.

I won't go into detail, but this report found that all motor vehicle owners were subsidized and that all motor vehicle owners, including owners of private passenger cars, should pay substantially higher taxes.

The principal point of difference in this study, as compared with the Eastman study, was that the railroad association's study assigned all motor vehicle owners as a group, a much higher percentage of the total cost of all highways, roads and streets. As I pointed out earlier, the treatment accorded this phase of the problem can make all the difference in the world.

A further study, entitled "Public Aids to Domestic Transportation," was prepared by the U.S. Board of Investigation and Research—Transportation, established by the Transportation Act of 1940.

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apart and identical in construction, one of which has been subjected to a high volume of truck traffic since its construction in 1929, while the other, built two years earlier, has carried little of this type of traffic.

The road with the greater truck traffic count is a section of Route 66 south of Glenarm in Sangamon County. This road, Hathaway's survey disclosed, has required patching of approximately twelve per cent of its surface in order to keep it in service.

The second road is Route 123 east of Tallula in Menard County. Although placed in service two years before the U. S. 66 section, this pavement has required no patching up to the present time with the exception of a few small blowups, caused by hot weather expansion, which involved less than one-fourth of one per cent of its surface.

In 1947, Mr. Hathaway's summary showed, the U. S. 66 section had an average daily count of 490 trailer trucks, while Route 123 had less than twenty of this type of vehicle.

Mr. S. C. Hadden, Chairman of the State Highway Commission of Indiana, says: "A greatly augmented and still increasing number of heavy trucks and trailers, operating for long distances at high speeds, is destroying our roads faster than we can find the money with which to replace them. Our maintenance costs are skyrocketing and the inflated cost of road building has almost cut in half the mileage of reconstruction and new construction our available dollars will buy."

"As a specific case," Mr. Hadden continued, "a recent study on highway No. 1 about 2½ miles north of Bluffton shows this highway was built in 1938 by the State Highway Commission of Indiana. The northbound traffic lane is pumping severely and breaking up. Over this traffic lane move heavily loaded stone trucks. The southbound lane at the same point carries the empty stone trucks returning to the quarry, and only normal additional truck traffic. The southbound lane is in excellent condition, free from pumping and faulting. Such evidence establishes the fact that pavement fails from frequency of overload, rather than from the forces of nature, as is sometimes contended. The weather was the same on both sides of the road; only the traffic was different."

Governor Duff of Pennsylvania, at the Governors' Conference in Colorado Springs, on June 22nd, 1949, said:

"We have been trying to find out in Pennsylvania, as accurately as we can, what damage has been done to our highways by heavy trucks. Here is one example that our highway department has cited to me of a prominent road that meets our Pennsylvania Turnpike.

"This road leads to Harrisburg in one direction, and to a city by the name of Carlisle in the other. I might say that this route, known as route No. 11, was built at one time, by one contractor, under identical road specifications. As the truck traffic and the heavy traffic from the Turnpike goes over this highway toward Harrisburg, the upkeep of the highway department is $4,900 per mile per year, and on another part of the same road, which has ordinary traffic—built at the same time and by the same contractor—the upkeep is $350 per mile per year. In other words, the ratio is about 16 to 1.

"On the Turnpike itself, where the heavy vehicles use the outside lane, the deterioration of the Turnpike on those lanes is marked as compared with the inside lanes."

Thos. H. MacDonald, Commissioner, Bureau of Public Roads, on Feb. 7th, 1949, before the annual meeting of the American Road Builders' Association in Washington, D.C., said:

"In 1931 I stated, 'The roads are more destroyed really by climatic and soil conditions than they are by any use that is made of them.' This statement was correct eighteen years ago, when it was made. The loads we were then carrying on the highways were very infrequently heavy enough to over-tax their structural capacity.

"In the intervening years there have been great changes in the total number of trucks on the highways, in the proportion of them with heavy loads and over-loads, and in the observed effect on highways.

"The volume of truck traffic is nearly three times what it was then. Even more significant is the proportion of trucks that carry heavy loads. In 1931 trucks traveled 11.4 billion miles on main roads. This year the figure may well reach 34 billion. In 1931 only about eight trucks in every thousand had axle loads of 18,000 pounds, and there were practically no axle loads in excess of 20,000 pounds. In 1947, 76 trucks in every thousand had axle loads of 18,000 pounds or more, 33 of which were 20,000 pounds or more, and 14 were 22,000 pounds or more.

"What has been the effect of this great increase in loading at, or in excess of, what in many States is both the design standard and the legal limit?

"During the early thirties a gradual increase in damage to pavements was observed. Prior to the war, damage had reached alarming proportions. With the marked increase in heavy loads since the end of the war, the damage has become even more alarming.

"*There is conclusive evidence that this damage is caused by heavy wheel loads.* Pumping was known, but was of little consequence during the twenties. Characteristically it occurred on clayey soils known to be inferior as road support. Now occurrence is widespread and includes pavements on sandy soils regarded as excellent road support. (This matter has been the subject of serious study by practically every highway research agency, and they all reach the same conclusion—the damage occurs only on pavements subjected to frequent heavy wheel loads and particularly overloads)."

The Commissioner of Public Roads, in a report to Congress last year, pointed out that pumping is caused by axle loads as low as 14,000 pounds:

"From widely distributed observations, the conclusion has been reached that detrimental pumping is generally associated with a substantial frequency of axle loading in excess of 14,000 pounds."

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This study was in substantial agreement with the Eastman study on the question of the proper share of total costs that should be assigned to motor vehicle owners and, therefore, concluded that motor vehicle owners as a whole had paid more than their share.

When it came to the question of apportioning costs among different sizes of motor vehicles, however, this report took a different approach. It did not attempt, as the Eastman report did, to assign different sizes of vehicles the increments of cost for which they actually were responsible.

It said, in effect, that the Eastman method was too difficult; that a simple yardstick should be used. It then selected as a yardstick gross ton-miles operated. By use of this yardstick, the report found that small vehicles had paid more than their share, and the large vehicles had not paid enough.

Because this staff report chose the gross ton-mile as a yardstick for measuring highway cost responsibility, the members of the Board of Investigation and Research itself refused to endorse it.

Since the opposition relies so heavily on the ton-mile basis of cost allocation, it has become a basic issue..

A ton-mile simply is a definition for measuring freight transportation volume, just as a passenger-mile is a yardstick for measuring passenger transportation volume.

A simple example might be helpful in understanding the fallacy of the ton-mile theory. If the ton-mile were used as a basis for determining railroad rates, freight rates would be so high that freight couldn't move, or passenger rates would have to be cut to the bone.

The U.S. Bureau of Public Roads had this to say with regard to the ton-mile method:

"The ton-mile method has the superficial and deceptive advantage of appearing to account in part at least, for several measures of relative benefit. It is far from precise, however, since 10 automobiles will occupy a great deal more space than one truck of the same total gross weight."

"When different commodities are involved, or passenger hauling is compared with that of freight, the relation of gross ton-miles to value of service becomes meaningless. The word 'ton-mile' has a scientific connotation and therein, perhaps, lies much of its appeal."

Again, Mr. Eastman considered the ton-mile theory at the time he made his study of "Public Aids to Transportation." He dismissed it as follows:

"The method is easy to compute but that does not commend it to us. There is no evidence which convincingly indicates that for every element of cost the charge should progress upwards as weight and mileage of vehicle increase. This (ton-mile) basis ignores in important respects the effects of differences in the ways in which loads are transmitted to pavements and roadway structures and in the utilization made of road facilities. It has, therefore, little merit."

The position of the trucking industry in this entire controversy is that the taxes and regulations imposed against

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Commissioner MacDonald recently pointed out that pumping is now occurring in roads laid on better than average soil. He said:

"The unusually heavy truck traffic on New Jersey's primary highways has produced serious pumping on soils that have been reported as resisting such action elsewhere in the United Sates. On one section of pavement on a better than average soil, serious pumping and faulting occurred over a period of years. Repeated repairs were required to maintain the pavement in serviceable condition. When reconstruction finally became necessary, it was found that many of the ¾-inch steel reinforcing bars placed across joints to prevent breakage of the slab, had themselves been broken. In 1947 this road carried a daily average of 1,300 axle loads of 16,000 pounds and over.

No studies of this character for individual states have been made in recent years, although a statement by the State Highway Engineer of California provides evidence that the heavy vehicles in California do not pay their fair share of road costs. In a letter dated December 17, 1948, from G. T. McCoy, State Highway Engineer, addressed to the Chairman of the Interim Committee of the Senate Committee on Transportation, Mr. McCoy stated that a separate study and analysis of each of the 105 major highway construction projects let to contract between January 1, 1947 and January 1, 1948, determined:

(1) That the additional cost of the construction of highways to accommodate "heavy vehicles" was 22.2% more than would be required for highways designed with no provision for heavy trucks and buses.

(2) That the logical basis for the determination of proportionate responsibility for costs incurred jointly for all vehicles, light and heavy, after deducting the cost solely chargeable to the heavy vehicles, was the proportionate amount of use, i. e. ton-miles. Data available to the Division of Highways showed that for the year 1946, heavy trucks and buses produced 45% of the total ton-miles of traffic on the state highway system. From these data, Mr. McCoy concluded that heavy vehicles were responsible for 55% of the total (construction) cost of the 105 projects as constructed.

Based on this information from Mr. McCoy, the Interim Committee in its report to the Legislature stated:

"It is concluded that heavy vehicles may reasonably be held responsible for 55% of the cost of constructing state highways. Obviously, they should also share in the joint burden of highway maintenance and administration. On the ton-mile basis, they would be assigned 45% of these costs. For all expenditures, then, heavy vehicles would be held responsible for about 52% of the total costs according to this (McCoy) study. As we shall indicate later, their estimated user payments under the present tax system amount to less than 35% of the total."

Whether or not trucks pay their fair share of road costs has been a subject of much debate with only rare opportu-

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Offered to adults (men and women) by the University of Illinois, in cooperation with the Western Society of Engineers and the Four Founder Societies.

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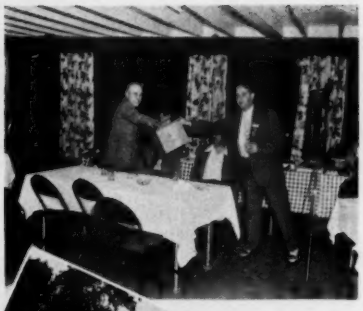

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1. The hard-working Golf Committee: C. Hershback, H. Hagedorn, W. Marston, R. Clark, T. Ek, C. Walls, S. Pollenz, G. Trees, J. Hadsall and A. St. Germain were absent.

2. The dinner—19th Hole.

3. Putting Green: upper left, committee table; center rear, old friends meet; front and right, trying for aces.

4. The Low Peoria 1st Prize Winner, Mr. Desmond was represented by Mr. Lockwood.

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5. Mr. Sedwick putting on the 9th Green, Messrs. Rease, Ford and Brinker watching.

6. First Door Prize drawing, Mr. Sedwick draws from "the box" with Ray Clark holding.

7. The Putting Green Contest, a WSE member feeds the "kitty."

8. Ladies' Low Gross Prize Winner, Mrs. Larner.

9. Mrs. Havlic and party on 9th Green.

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Oct. 23 FALL DINNER Speaker	**Oct. 30** HYDRAULIC, SANITARY AND MUNICIPAL ENGINEERING SECTION Sponsor Speaker	**Nov. 6** JOINT MEETING—MECHANICAL ENGINEERING & FIRE PROTECTION & SAFETY ENGINEERING SECTIONS Sponsor Speaker	**Nov. 13** GAS, FUELS AND COMBUSTION ENGINEERING SECTION Sponsor Speaker
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Dec. 18 ELECTRICAL ENGINEERING SECTION Sponsor Speaker	**Dec. 25** NO MEETING	**Jan. 1** NO MEETING	**Jan. 8** JOINT MEETING—BRIDGE & STRUCTURAL ENGINEERING & TRANSPORTATION ENGINEERING SECTIONS Sponsor Speaker
Jan. 15 COMMUNICATIONS ENGINEERING SECTION Sponsor Speaker	**Jan. 22** CHEMICAL & METALLURGICAL ENGINEERING SECTION Sponsor Speaker	**Jan. 29** WOMEN'S DIVISION Sponsor Speaker	Over →

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YOUR W.S.E. CALENDAR

(CONTINUED)

Feb. 5 JOINT MEETING— CHEMICAL AND METALLURGICAL & GAS, FUELS & COMBUSTION ENGINEERING SECTIONS Speaker	**Feb. 12** BRIDGE & STRUCTURAL ENGINEERING SECTION Speaker	**Feb. 19** WASHINGTON AWARD DINNER Speaker	**Feb. 26** OPEN DATE Speaker
Mar. 5 JOINT MEETING— ELECTRICAL ENGINEERING & COMMUNICATIONS ENGINEERING SECTION Speaker	**Mar. 12** TRAFFIC ENGINEERING & CITY PLANNING SECTION Speaker	**Mar. 19** SOCIAL EVENING Speaker	**Mar. 26** BRIDGE & STRUCTURAL ENGINEERING SECTION Speaker
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1950-51

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Measuring Circulating Water Flow

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water from the pressure cylinder. The pressure normally used was 50 lbs. per sq. in. The quick-opening valve was operated manually and it required a little more than one second to open and close the valve. When the brine solution in the stream of water arrived at the first electrode and changed the conductivity of the water, the recording pen began to swing with greater amplitude, increasing the width of the band appreciably. This soon tapered off to normal width, indicating a return to normal conductivity of the river water. The meter was then switched to the second electrode by a double-throw switch. When the brine arrived at the second pen a few seconds later the recording action was repeated. The strip chart continued to move at a constant speed so the time between the appearance of the brine solution at the two electrodes could be very accurately measured. When the pen returned to normal amplitude, the chart was stopped and all switches set for a repeat operation.

Recharging the pressure cylinder with a new brine solution between the runs took about two minutes. At least three runs were made for each condition of pump operation in order to have a record of average operating conditions. A complete series of runs required about 10 to 15 minutes. The time of passage between electrodes varied from over two minutes for the low flows tested to less than 25 seconds for the maximum flows. Water velocities varied from 1.6 feet per second to 9.0 feet per second.

The plan for making these tests had been developed on the assumption that all test runs would have to be made under normal plant operating conditions, and very little latitude would be permitted in the volume of water pumped. During the progress of the tests, however, it was necessary to take the generator out of service, and it was then possible to test the pumps over a wide range of conditions. Advantage was taken of this opportunity and the testing program expanded to measure flows which varied from 27,760 gallons per minute with one pump operating under a throttled condition, to 153,198 gallons per minute with two pumps operating at maximum capacity and with a minimum head.

In order to obtain the variations of flow in the circulating water system, the butterfly valves on the condenser were closed to various settings as noted on a position indicator on the valves. No attempt was made to set the valves for any particular flow. A reasonable time was allowed after each change in valve setting to establish a condition of uniform flow throughout the system. Each pump was tested over a range from about 1/3 capacity to full capacity. The tests made with both pumps operating, however, were made with all valves wide open.

Calculations Required

Since the turbulence of the water tends to elongate the brine solution in the water stream, the length of the record is usually somewhat greater at the second electrode than at the first. From the experience of previous investigators utilizing this method of testing, it has been found that the average velocity of the water can be determined most accurately by observing the mean time of passage of the brine between the electrodes. The graphical record made by the Brush Oscillograph was in the form of a 60-cycle sine wave. An envelope curve through the points of maximum swing of the pen on both sides of the neutral axis enclosed an area on the chart for each electrode. The mean time was represented by the distance between the centers of gravity of these areas plotted for both electrodes. In making these calculations it was necessary to note the exact time of the first indication of an increase in amplitude and also to observe the time that the brine solution appears to have completely passed the electrode as evidenced by a return of the pen to approximately normal vibrations. The centers of gravity of the areas were determined by an analytical method which may be briefly described as follows:

The areas were divided into narrow increments five millimeters (2/10 second) in width, the chart's speed being 25 millimeters per second. Moment areas were then computed about a line drawn through the point on the chart where the first indication of a change in conductivity was evident. The sum of these moment areas divided by the total area resulted in a distance in millimeters from the point of first indication or start, to the center of gravity of the area. These calculations were made for areas on all charts. The distance was measured between the centers of gravity of the initial and final areas. This distance was converted to time, since the chart speed was constant, and this is the mean travel time of the brine solution between the two electrodes. The distance in feet between electrodes divided by time in seconds represents the mean velocity of the water column in the pipe. This pipe being an 84-inch O.D. steel pipe encased in concrete, the net area of the cross section of the water column was 37.80 sq. feet. The product of this area and the mean velocity were then equal to the volume of water being delivered by the pump or pumps, depending on whether one or two pumps were operating at the time of the tests.

Results Obtained

Some of the data collected in these tests and the calculated volumes of water pumped are shown in the tabulation. For comparison with theoretical calculations, the volume estimated from the manufacturer's performance curves and the percentage of variation from the measured values are also shown on the exhibit.

Once the apparatus is set up it is possible to make a large number of test runs in a short space of time. The data collected can be verified with subsequent test runs if comparable test conditions can be reproduced. It was found necessary to test and check the apparatus carefully, particularly the underwater connections as these would interfere with the successful continuity of a series of tests. Considerable time was spent in checking the volume and concentration of brine necessary to produce the best oscillograph records. Apparent variations in the river water conductivity from day to day prevent volumetric determinations, and a few check runs

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Measuring Circulating Water Flow

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were necessary before starting each day's tests.

Conclusions

The accuracy of the salt-velocity method of water measurement has been well established by other experimenters. Any device which will more accurately record the changes in current flow or improve the method of obtaining the time of travel between the electrodes should increase the accuracy and decrease the possible sources of error.

The Brush Oscillograph is an instrument which combines the accurate recording of the current flow with accurate timing. The results obtained, therefore, should be well within the limits of accuracy as determined by others in laboratory calculations. The variations noted for the calculated flows from the mean values for identical pump conditions were within very narrow limits, and could be accounted for by variations in river conditions, pipeline turbulence, and losses incident to such a circulating water system with so many changes in pipe sizes and directions of flow.

Improvements in the method of injecting the brine solution into the system might have shortened the time the brine column was passing an electrode, but it could not have changed the time of passage between electrodes. Smaller areas on the strip chart indicating the passage of brine columns past the electrode might have reduced the work of calculating the locations of the centers of gravity, but probably would not have increased the accuracy of the results materially.

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Personals

James Clinton Peebles, dean emeritus of engineering at I.I.T., has been appointed chief of the Illinois Commerce Commission. Chairman Walter T. Fisher, in making the appointment, commended Peebles as an administrator and said the appointment was in line with a policy of staffing the commission with experienced specialists.

Prof. Fred B. Seely of the University of Illinois college of engineering has been honored for distinguished contributions to the advancement of engineering teaching. He received the Lamme medal June 22 at the national convention of the American Society for Engineering Education, meeting at the University of Washington. Last November, he received the Worcester Reed Warner medal of the ASME.

Burgess Hill Jennings, chairman of the department of mechanical engineering at Northwestern University, and engineering consulant to the Argonne National Laboratory, has been named a Fellow of the American Society of Mechanical Engineers.

September Advertisers

Technical Education Is Not Enough

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to many of our greatest difficulties in American today. The political structure in which we take so much pride, our great United States Constitution, was formulated, in its own language, "to establish justice, insure domestic tranquillity and promote the general welfare." Is it reasonable to think that these ends can be achieved through words alone, without continuing, re-inforcing action by every citizen of the nation? Does our conduct as individuals and technicians always bear close examination as a contribution to justice and tranquillity and the general welfare? If we had devoted as much of our individual effort to the achievement of justice and tranquillity and the general welfare, as we have to technical progress, is it unlikely that we would be faced now with the many conflicts and problems arising from the fact that we have relinquished to the State many functions and responsibilities that we should have kept as our own?

You and I hear and take part today in a lot of conversation about how we can stop the trend toward socialism in America. If I am sure of anything, I am sure that we can't stop the trend toward socialism by talking about it, or by talking about all the evils it has led to elsewhere and may lead to here. Nor is it certain that we can stop it altogether by replacing one set of elected government officials with another, however desirable that may be for other reasons, because essentially the trend arises not alone from the will of our elected and appointed officials but from the will of a people seeking justice, tranquillity and the general welfare, and not knowing how to find these desired ends.

Actually, of course, these ends cannot be achieved through socialism, any more than they can be achieved through any other mere doctrine. If they can be achieved at all it must be done instead through effort. It must be everybody's effort, of course, but the technical leaders of a technical society cannot escape their responsibility for leadership. Until our acts reveal devotion to these great causes they can never be realized in any true measure, and this means that we must turn some of our attention away from technical progress to insure the survival of our economic society as we know it.

There are a few hopeful signs that this is being done. Increasingly we find the leaders of our technical society, people like yourselves, turning away from their professional and business lives and accepting responsibilities in the education and welfare activities of the community. Increasingly, too, we see technical leaders assuming political responsibilities—and it is in this area, I think, that our failure as citizens has been most shameful. Too many of us, I am afraid, have failed to accept even the very minimum of political responsibility, that of informing ourselves on the issue and the candidates and then voting. Until we have done this and much more, how can we expect a political system, based on the sovereignty of the people, to work? The fact is that it can't possibly work very well until people like yourselves, technical leaders, are willing to accept the high responsibilities of office-holding and law-making.

Our greatest hope for the future, however, lies in the evidence of still another awakening interest in our technical society—an interest in spiritual and moral as well as technical values. Church memberships are growing as people reach out for something they are aware is missing in their lives. Books whose message is a spiritual message are on best-seller lists for the first time in our history, and, this is especially important I think, these books are in greatest demand on our college and university campuses. Here again, however, it is our technical leaders on whom we must depend to give the movement toward spirituality the strength and vigor and endurance that will make it meaningful. Can we turn aside from technical progress to contemplate the greatest and most neglected admonition that has ever been given to man: "Love thy neighbor as thyself?" If we can, we will find our way out of the difficulties we are in and any others that may come to us. If we cannot, surely we are doomed.

What each of us needs most, I am convinced, is something that I cannot describe but can illustrate. It is the spirit of the nursing Sister about whom this story came back from the Nationalist war front in China. In a mission hospital, the Sister was tenderly caring for a dirty Chinese soldier whose ugly, festering wounds were an offense to the senses. A war correspondent in the ward looked on for a moment, and said: "Sister, I wouldn't do your work for a million dollars!" The Sister looked up and smiled, then replied quietly: "Neither would I!"

Above left, to right, Dr. Henry T. Heald, speaker of the evening, and recipient of Honorary Membership; H. P. Sedwick, president of WSE for 1950-51; Dr. Gustav Egloff, outgoing WSE president; Joshua D'Esposito, recipient of Honorary Membership, and Verne O. McClurg, past president.

Close '49-50 Year at June Dinner with Awards, Honors

Western Society's annual June Dinner, held June 5, ended the fiscal year on a cordial note of awards, honors, and informal talks. An attendance of 546, possibly the largest in WSE history, was recorded.

Gustav Egloff, WSE president for 1949-50 greeted the guests and introduced the members of the Board of Direction. After the awarding of honors, he summarized the year's activities and turned the gavel over to H. P. Sedwick, the incoming president. Mr. Sedwick, after a brief statement of his aims for the current administration, introduced the speaker of the evening, Henry T. Heald, president of Illinois Institute of Technology.

Dr. Egloff presented Life Memberships to 86 recipients this year, of whom almost half were present.

He announced that there were 14 contestants in the Cash Award contest, and that the following three had been selected by the Awards Committee as the prize winners:

C. J. McLean, of Public Service Company of Northern Illinois, first prize, for his paper, "Measuring Circulating Water Flow by the Salt-Velocity Method." (Reproduced in this issue.)

Paul Rogers, of Sargent and Lundy, second prize, "The Structural Aspects of Power Plant Design."

Charles A. Blessing, Chicago Plan Commission, third prize, "Surveying and Mapping for Modern City Planning."

For the first time, Service Awards were given to WSE members for exceptional and unselfish service to the Society. These awards were established in May, 1949, and three men were chosen as the first recipients.

They were: E. Gordon Fox, executive vice-president of Freyn Engineering Co., "for his prodigious effort in procuring and establishing the present headquarters of the Society."

Ralph S. Peterson, Commonwealth Edison Company, "for his work as chairman of the 1947-48 Membership Committee which obtained the most new members of any single year in the history of WSE." (This record was broken in 1950).

John F. Parmer, Mundie, Jensen and McClurg, "for his work as chairman of the present Educational Committee which successfully inaugurated and managed a program of technical and non-technical education courses."

Donald R. Klusman, Illinois Bell Telephone Company, was presented with the Charles Ellet Award for his competitive paper, "Mechanical Accounting for Metropolitan Telephone Service."

The highest honor which the Western Society of Engineers can bestow upon a member is that of Honorary Membership. This year two members, Joshua D'Esposito and Henry T. Heald were so honored.

Joshua D'Esposito was recommended for Honorary Membership because of his "outstanding service to the engineering profession and to the City of Chicago" on such projects as the subway system, the large sewage treatment plant and

sewer construction program, and railroad terminals. He is a consultant to the city on these projects.

Dr. Heald was recommended for Honorary Membership for his "outstanding service to the engineering profession" in the structural engineering field and in technical education. He was associated with Armour Institute of Technology from 1927 to 1940, rising to Dean of the College, and has been president of Illinois Institute of Technology since its formation in 1940.

As Dr. Egloff explained, "one of the duties—and privileges—of the president of the Western Society of Engineers is to report on the general condition of the Society at its annual meeting."

He reported the fact that the WSE headquarters is completely paid for. More than $120,000 in cash was received for the headquarters, in addition to contributions of time and services.

After describing the WSE Headquarters improvements, he urged greater use of the facilities by members.

Another interesting financial report concerned the Society's income for the year. This is the third time in ten years that WSE has operated in the black, showing about $2000 income over expenditures.

The "news flash" of the dinner was the announcement by Dr. Egloff that "Lou Gabbard and his committee have broken all previous records for number of membership applications in any one year. They have obtained 543 new applicants.

Mr. Sedwick Speaks

"I am honored to have been chosen as one of the leaders of Western Society of Engineers during these past several years, and again during the coming year.

"Dr. Egloff has told you of the Society's progress during the past year, and the policy of our Society will remain unchanged during the coming year.

"The Society is made up of individuals but with the distinct provision that the Society as such is not intended, nor will be used, for the personal benefit of any member, excepting insofar as he may benefit from his personal associations with other members; his improvement in engineering knowledge; and his satisfaction from being helpful in good work.

"Our program for the coming year will lay emphasis on service which we may be able to render the public generally; conducting programs which will be of increasing interest and benefits to our members; and encouraging members to greater participation in the Society's activities.

Introduction of Dr. Heald

"It is a pleasure to have an outstanding citizen of our own community address us at this annual meeting. He really needs no introduction to this group as he has been an active member for many years and is past president of the Society. He is also president of one of our very fine institutions, the Illinois Institute of Technology. More than that, however, he is an outstanding example of an engineer who has fulfilled the aims of our Society in being of service to the community. . . He will talk to us tonight about activities of the Illinois Institute of Technology and of the associated organizations, such as Armour Research Foundation, and the Institute of Gas Technology. Ladies and gentlemen—Dr. Heald."

In introducing his subject, Dr. Heald acknowledged that the professional man takes some responsibility for the education of young men in his profession, and thus is vitally concerned about trends in such education.

He estimated that 93,000 freshmen were enrolled in engineering schools in 1946, but that by 1949 this had dropped to 42,000. In 1949, about 45,000 were graduated, and this year there were about 47,000. Next year, not more than 35,000 will be graduated, and the number will decrease until the pre-war rate of less than 20,000 is reached, according to Dr. Heald.

How will this affect the supply of engineers? Dr. Heald said, "A pre-war study indicated that 17,000 to 18,000 people were needed each year—because of this supposed gap, I am sure a good many young people have been staying away from engineering. Last year, however, more than 35,000 found engineering jobs. The balance went on to graduate school so we have no information on them.

"There is no great surplus indicated this year," he said. "This is a product of the continuous expansion of engineering each year. We believe that within the next few years the crop of 17,000 to 18,000 graduates will be entirely inadequate.

Dr. Heald pointed out that the tenth anniversary of the founding of I.I.T. would be celebrated in July, 1950. "There are a few points which might be of interest," he said. "5,257 young men and women have received college degrees, and of those, 3,961 were in engineering, and 456 were graduate degrees.

"Ten years ago I.I.T. had a campus of 7 or 8 acres. It now owns a campus of 85 acres, and has 25 more to go to round out the area on which we envisage the Technological Center.

"Ten years ago the combined resources totaled about $5 million, the enrollment was about 5800," Heald said. "Now I.I.T. has resources of $17 million.

AN OPEN LETTER TO ALL WSE MEMBERS

Dear Member:

Your interest in our Society can best be demonstrated by your convincing fellow engineers to join and take an active part in our organization. We would appreciate very much if you would note the name and address of qualified engineers and either mail or phone this information to the WSE Headquarters at 84 E. Randolph St., Chicago 1, Ill., telephone RAndolph 6-1736, c/o Membership Committee. Your Membership Committee will take over from there.

There should be no difficulty in interesting engineers to join WSE if they are apprised of the Society's activities as well as the facilities of our Headquarters.

WSE is a good solid organization and we sincerely hope to feel the effect of your backing by the receipt of possibly 2500 names. We thank you very much and shall give you a report, indicating your cooperation, in the next issue.

Yours very truly,
Paul L. Hedstrom, Chairman
Membership Committee

Leroy F. Bernhard
Raymond W. Clark
Miss Georgiana Peeney
James W. Schaefer

C. H. Elder
L. C. Gabbard
Norman E. Brown

CRERAR LIBRARY Notes and News

The summer months at The John Crerar Library have seen continued progress in the review of the library's collections. A program is being carried forward to dispose of non-scientific and non-technical publications now in the library and to use receipts from the sale or exchange of these publications to strengthen the library's collections in technical books and journals. For example, the library has been able to acquire a complete set of *Nickelberichte*, the official publication of Nickel-Information-Buro in Germany, which has not been recorded as being available anywhere else in Chicago.

A special effort is also being made to increase the library's list of current subscriptions to newly established journals. In the field of engineering interest there have been some important additions. Some of these, with the title and year of first publication, are the following:

Applied Hydraulics, 1948
Australian Foundry Trade Journal, 1949
Highway Research Review, 1949
Journal of Metals, 1949
Journal of Petroleum Technology, 1949
Mining Engineering, 1949
Science and Engineering, 1948
South African Mining and Engineering Journal, 1948
Techniques de l'ingenieur, 1949

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The Crerar Library is included among a group of 31 American libraries that have been named as official depositories for complete sets of atomic energy declassified and unclassified research reports issued by the Atomic Energy Commission. In assuming the obligations of a depository, the library has agreed to provide reference service, and to make available photocopies in accordance with the library's established prices for such service. In the latter connection, the library has recently issued a new schedule of prices involving a marked reduction from the prices in effect before September. The objective in this service is to give technical personnel prompt photocopying service at the lowest possible cost.

Col. Slezak to Speak at Annual Fall Dinner Scheduled Oct. 23

Col. John Slezak (WSE), an industrialist with unusually varied interests, will be the guest speaker at the annual Fall Dinner of the Society, to be held October 23. He is president of the Turner Brass Works, Sycamore, Ill.

Among the organizations which claim Col. Slezak's attention are the Illinois Manufacturers' Association, of which he is vice-president, American Ordnance Association (director), and Illinois Institute of Technology (trustee).

In addition to his presidency of the Turner Brass Works, he is chairman of the board of the Kable Printing Co., Mt. Morris, Ill., and of the Pheoll Manufacturing Co., Chicago; and is a director of the Whiting Corporation, Harvey, Ill.; Felt & Tarrant Manufacturing Co., Chicago; Burgess-Norton Manufacturing Co., Geneva, Ill.; and the Illinois Bell Telephone Co.

Notes of Interest to Engineers

Engineering Societies Personnel Service announced the appointment of E. P. Berg, general Manager, Link-Belt Company, to represent A.S.M.E. on the Chicago Advisory Committee of E.S.P.S. Mr. Berg fills a vacancy created by the retirement of C. C. Austin, general manager, Mancha Division, Goodman Manufacturing Co.

E.S.P.S. has appointed a new staff member, Bonnell H. Allen, a registered professional engineer, to assist with placement of engineers.

* * *

The Westinghouse Electric Corporation has received a $181,600 order for the installation of elevators in the 14-story apartment building being erected at 4950 Marine Drive.

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A compilation of 44 Graphical Symbols for Railroad Use, has been approved by the American Standards Association.

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The Chicago Post Office has made plans for the assistance of Chicago area residents in the event of a catastrophe. Employees are being trained in first aid, and all carriers, drivers, and special delivery messengers will form a voluntary group of approximately 5,000 uniformed men to assist in caring for injured.

Jelinek Dies

Otto K. Jelinek (M'36) died in Europe August 18 of a heart attack.

As the Chicago Daily News stated on August 21, his death "is a distinct loss to Chicago and to the engineering profession."

Mr. Jelinek had been with the Park District from 1918 to 1946, and was instrumental in developing Chicago's lake front, and other installations. Among his notable designs was the flexible-curb system on the Outer Drive, installed in 1935. Since 1946, he had been associated with Ralph Burke in airport planning and construction.

He was awarded the Octave Chanute medal in 1938, and was active in WSE affairs, including chairmanship of the Transportation Section last year, and of the Traffic Engineering and City Planning section earlier.

He was the current chairman of the Illinois section of the American Society of Civil Engineers.

News of WSE Members

Dr. J. T. Rettaliata, (WSE), dean of engineering, I.I.T., has been nominated as regional vice-president of the American Society of Mechanical Engineers. James D. Cunningham, president of Republic Flow Meters Co., is outgoing president.

E. Gordon Fox, (WSE), has been appointed executive vice-president of Freyn Engineering Co., subsidiary of Koppers Company, Inc., and E. J. Westcott, (WSE), has been appointed secretary and treasurer of Freyn.

Thomas H. Coulter, (WSE), president of the American Bildrok Company is the new president of The Executives' Club of Chicago.

Dr. L. E. Grinter, (WSE), research professor of civil engineering and mechanics at I. I. T., has been elected vice-president of the American Society for Engineering Education.

E. L. Michelson, (WSE) section engineer, Commonwealth Edison Company, took office June 1 as chairman of the Chicago Section, American Institute of Electrical Engineers. W. M. Ballenger, (WSE) district manager, engineering department, General Electric Company, is secretary of the AIEE, and R. R. O'Connor, (WSE) transmission engineer, Illinois Bell Telephone Company is treasurer. Two other WSE members, F. A. Cox, and J. A. Romano, are members of the executive committee.

Neal D. Howard (WSE) is secretary of the American Railway Engineers Association, 59 East Van Buren St.

Harold C. Conners (WSE) has been recalled to active duty with the Air Force. As a paratrooper in World War II, he spent 23 months in Africa, England and Italy in a special section of operations, 15th Air Force. He holds the rank of Major and will join the Operations sections of the 437th Troop Carrier Wing as Liaison Officer-Airborne Troops.

Dr. Arthur Bessey Smith (WSE) was awarded the honorary degree of Doctor of Engineering at the University of Nebraska, June 5. For many years he was chief research engineer of Automatic Electric Company, and now is vice-president of Automatic Electric Laboratories, Inc. He joined WSE in 1920 and was awarded Honorary Membership in 1949.

H. J. McCreary (WSE) was awarded a professional degree in electrical engineering from the University of Nebraska on June 5.

Mr. and Mrs. Leo T. Turner

Shown above, cutting their wedding cake, are Leo T. Turner (WSE), and his bride, the former Miss Bonnie Weir, who was a WSE staff member. Neighbors for a number of years, they were married July 15 at Graham Taylor Chapel of the University of Chicago.

Donald N. Becker, WSE first vice-president, has been appointed to the Structural Engineering Examining Committee of the State of Illinois.

Dr. Gustav Egloff (WSE) spent four weeks abroad this summer, visiting England, Scotland, France, Germany, Switzerland and Italy. He attended the Second Oil Shale and Cannel Coal Conference in Glasgow, Scotland, presenting two papers and presiding over one session. He also attended the Fourth World Power Conference in London, England, where he presided over one session. He also addressed oil groups in Rome and in Paris. He has been elected a Fellow of the Royal Society of Arts of Great Britain.

At the national meeting of the American Chemical Society to be held in Chicago September 3 to 8, Dr. Egloff will address the symposium on "Communication of Chemical Information," on September 6. His subject will be: "Interpreting Chemistry to the Layman."

WSE Golf Tournament Held

(*See photographs on Page* 14)

The first annual WSE Golf Tournament, at the Nordic Hills Country Club in Itasca, Illinois, attracted more than 150 WSE members and guests. The all-day outing, including golf, dinner, and special events, was planned and carried out by a special committee under the direction of Ray W. Clark.

The day proved that engineers are good golfers. The three lowest gross scores and the "Chief Engineers" shooting them were: T. E. Meeker (73), C. Herschbach (77), and H. Kastman (77). The four lowest scores under the Peoria System were tallied by the following "Assistant Chief Engineers:" J. J. Desmond (59), S. B. Stoler (63), G. Seabrooke (63), and J. T. Noble (63).

Along with the other professional and non-professional golfers were three ladies, Mrs. W. T. Larner, Mrs. W. J. Seibt, and Mrs. A. C. Havlic. Mrs. Larner received a prize for a low gross of 103.

A popular contest was the "Nearest to the Pin" contest on the 13th hole. On this short but tricky 88-yard drive, five engineers found the range: H. Ley (30″), D. E. Inman (38½″), G. Anderson (39″), J. Grinis (41″), and O. S. Murphy (48″).

Another outstanding event was the putting contest, won by G. Herd, A. Rivenes, and M. Thompson, each with a score of 17 for the 9 putting holes. Each won golf balls for his efforts.

After a prime-rib roast-beef dinner, W. R. Marston, our Program Chairman, acted as Master of Ceremonies.

A surprise to many was the announcement of a charge of ten cents from each person wearing a necktie—that item of apparel not being accepted attire at a WSE Golf Tournament.

Our president, H. P. Sedwick, spoke very briefly, proving that he is a man of few words. L. W. Tuttle also spoke briefly (surprisingly), and J. Earl Harrington, our executive secertary (who had paid ten cents), said hello.

Ray Clark then presided over the awarding of some 45 prizes, including an electric toaster, deep fryer, carving set, electric clocks, golf bags, fog lights, table lamp, raincoat, tee shirts, golf shirts, golf caps, flashlights, belts, club socks, gloves, and golf balls.

The good people donating these excellent prizes were the following: Combustion Engineering Co., Rockwell Manufacturing Co., Link-Belt Co., Ragnar Bensen, Public Service Co. of Northern Illinois, Commonwealth Edison Co., Pete Voss and Assoc., Mutual Truck Parts Co., Inc., White Motor Co., Merrill & Co., The Eimco Corp., Motive Parts Co. of America, Universal Oil Products Co., Pacific Flush Tank Co., Portland Cement Co.

A complete list of prizes and who won them will be posted on the sixth floor bulletin board during September. Also on display will be a complete set of twenty photographs taken at the tournament by Stanley Pick. Any picture may be obtained at a nominal fee to cover costs.

To those who came—our sincere thanks: to those who didn't or couldn't —you missed a grand time; to all of you —we hope to see you at the second annual Golf Tournament next summer.

Col. H. A. Allen Dies At 83

Col. H. A. Allen, a former city engineer, died August 18 at Hines Veterans Hospital. He was 83 years old.

Col. Allen had been a member of WSE from 1919 until he resigned in 1948. He was in charge of Chicago's water pumping stations from 1912 until his retirement in June, with the exception of the time he spent in the Army.

He was World War I commander of Chicago's 108th combat engineers which he helped to build up as a national guard regiment prior to that war.

He had graduated from the naval academy at Annapolis in 1887, serving in the Navy for two years, and later in the Naval reserve. He was appointed a Lieutenant Colonel of engineers in the Illinois National Guard in 1912.

THE CASE FOR THE TRUCKS

Chester G. Moore

(*Continued from Page* 12)

us should be based on fact. On the basis of the facts, as we know them, we sincerely believe that motor trucks do pay their fair share of highway costs.

When and if it can be shown, without resort to fallacy, that motor trucks do not pay their fair share of highway costs, the trucking industry stands ready, willing and able to meet its obligations.

There is another phase of the attack against the trucking industry with respect to which I would like to state our position, although it is only indirectly related to the subject before us. I speak of the overloading of trucks and alleged damage to the highways.

We say that the answer to overloading where it exists is enforcement of the load limit laws, just as the answer to speeding by motorists is enforcement of the speed laws.

It appears that there are several questions to be answered before there can be a solution. Among current studies are tests in Pennsylvania under leadership of the U.S. Bureau of Public Roads. These are designed to determine the proper relationship between highway economics and motor vehicle economics, and the objective is to determine the pattern of highway and motor vehicle construction for the future. Our industry is contributing its money, time and effort in cooperating in these tests.

When a highway deteriorates some blame it on the weather, some blame the truck, others say it is a combination of both these factors plus faulty subgrade, improper construction and other things.

I know that there is a general feeling among highway engineers that when it comes to weight the appetite of the truck operator is insatiable.

But let's stop a moment and remember that it hasn't been too long ago when Kentucky allowed a *gross weight* of only 18,000 pounds. And Texas allowed a payload of only 7,000 pounds, unless the truck was going to or from a railroad terminal, in which case 14,000 pounds were allowed. These and countless other arbitrary laws were adopted under the guise of protecting the highways. We still have in existence many other laws which are just as arbitrary, although perhaps not as restrictive.

At what point does a state law become a restriction necessary to protect the highways rather than to protect a competing form of transportation? When we have a clear-cut and scientific answer to that question much of the difficulty will dissolve.

THE CASE AGAINST THE TRUCKS

Col. John W. Wheeler

(*Continued from Page* 12)

nity for a decision as to who is right. However, we have here in Illinois definite proof that heavy trucks fail to pay their fair share of the cost of Illinois roads.

Some years ago a group of interstate trucking companies sued Illinois in Federal Court contending that registration fees assessed against them were excessive and, therefore, an unconstitutional burden on interstate commerce. The case was tried on affidavit and comprehensive evidence was submitted by the truckers and the State. The evidence was under oath and subject to cross-examination by both parties. After a full review of all of the facts in this adversary proceeding, the Federal Court found against the heavy truckers. The Court found that the charges were not excessive and, therefore, did not constitute a burden on interstate commerce. It found the largest truck weighing more than 24,000 pounds should have paid almost four times as much as was assessed against it. This was the case of Brashear vs. Hughes. The full opinion of the Court with its finding of fact and conclusions of law may be reviewed in 26 Federal Supplement, page 908.

As far as I know, this is the only instance where a Federal Court has had occasion to formally rule on this question. The Court's opinion was based upon a cost study made by the Division of Highways of the State of Illinois. While this study was made for the year 1936, it should be noted that there have been no material changes in the rates of motor vehicle taxation since that date and that the findings made at that time are applicable today.

After considering the statements of the above public officials, who are charged with constructing, maintaining, and administering our highways, it is very evident that heavy trucks destroy highways.

Only when heavy truck licenses and fees pay the additional cost for constructing stronger highways, the additional maintenance caused by them, and their share of amortization, will they pay their proportionate share of highway cost and maintenance. They are not doing it now.

WSE Applications

In accordance with the By-laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Junior, Member, Associate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admission, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office, 84 E. Randolph St., RA ndolph 6—1736.

445-81 Morris M. Buzan, 3106 Burton St., Alton, Ill., attending University of Illinois.

447-81 John P. Clennon, Engineer, The Peoples Gas Light & Coke Co., 122 S. Michigan Ave.

450-81 Norman V. Yost, 4532 Main St., Downers Grove, Ill., attending Purdue University.

453-81 William A. Krick, Division Plant Supt., Illinois Bell Telephone Co., 212 W. Washington St.

454-81 Robert K. Barrow, 4936 N. Sheridan Rd., attending Illinois Institute of Technology.

455-81 Brooks T. Hogan, Chief Metallurgist, Al. Fdy., Howard Foundry Co., 1700 N. Kostner Ave.

456-81 Charles P. Lindgren, 48 N. Lockwood Ave., attending Illinois Institute of Technology.

459-81 Walter C. Shaw, Jr., Engineer, Illinois Bell Telephone Co., 208 W. Washington St.

460-81 William V. Haberer; Designer, Draftsman, Sargent & Lundy, 220 S. State St.

461-81 George W. Scalamera, 6007 S. Wood St., attending Illinois Institute of Technology.

462-81 Mrs. Marylin (Philip) Bolten, Assistant Engineering Chemist, City of Chicago, Testing Div., 3100 S. Sacramento Blvd.

463-81 John P. McGovern, Executive Chief Engineer, Union League Club, 65 W. Jackson Blvd.

465-81 Bryan J. Murphy, 3237 W. Diversey Ave., attending Illinois Institute of Technology.

472-81 Eugene R. Grotnes, 308 North St., W. Lafayette, Ind., attending Purdue University.

473-81 Joseph L. Tite, 257 Ellsworth St., Gary, Ind., attending Purdue University.

474-81 John E. Nohren, Jr., 406 N. Ellsworth St., W. Lafayette, Ind., attending Purdue University.

475-81 William M. Swanson, Cary Hall, W. Lafayette, Ind., attending Purdue University.

476-81 Donald R. Ulbrich, 234 Littleton St., W. Lafayette, Ind., attending Purdue University.

477-81 William D. Clynes, 234 Littleton St., W. Lafayette, Ind., attending Purdue University.

478-81 Thomas B. Weber, 234 Littleton St., W. Lafayette, Ind., attending Purdue University.

479-80 Peter B. Cadon, 308 North St., W. Lafayette, Ind., attending Purdue University.

487-81 Ralph R. Gross, 1119 N. Harding Ave., attending Arkansas State College.

488-81 Thomas E. Paintin, 216 Berkley Ave., Elmhurst, Ill., attending State University of Iowa.

489-81 Reigh C. Gunderson, 351 Northwestern, W. Lafayette, Ind., attending Purdue University.

491-81 Anthony W. Huberty, Director of School of Draft. & Design, Industrial Training Institute, 5129 N. Damen Ave.

493-81 J. F. Murphy, Owner, Murphy Concrete Construction Co., 9746 Walden Pkwy.

495-81 Arno G. Seegers, 2600 Fletcher St., attending Purdue University.

496-81 Donald K. Seibert, 6645 N. Keating Ave., attending Illinois Institute of Technology.

497-81 Donald K. Nelson, Engineer, Commonwealth Edison Co., 72 W. Adams St.

498-81 John V. Sunkel, Supervising Engineer, Commonwealth Edison Co., 72 W. Adams St.

499-81 Robert T. Summers, Jr., 5434 Woodlawn Ave., attending Illinois Institute of Technology.

500-81 Lee F. Conway, Plant Engineer, Illinois Bell Telephone Co., 75 E. 137th St.

501-81 Raymond D. Wallace, Works Manager, Spencer Chemical Co., Box 248, Glenco, Calumet City, Ill.

502-81 Robert D. Grubb, Engineer, Maint. Engr. Staff, Illinois Bell Telephone Co., 208 W. Washington St.

503-81 William J. Eder, Plant Engineering Assist., Illinois Bell Telephone Co., 5643 N. Broadway.

504-81 Edward F. Ream, Jr., Chief Engineer, Pacific Flush Tank Co., 4241 Ravenswood Ave.

505-81 Richard L. Musselman, Draftsman, Commonwealth Edison Co., 72 W. Adams St.

506-81 Donald T. Sapit, Student Engineer (Co-op), Hotpoint, Inc., 5600 W. Taylor St.

507-81 John A. Carron, 6243 S. Campbell Ave., attending Illinois Institute of Technology.

508-81 William J. Cadigan, 6218 S. Campbell Ave., attending Illinois Institute of Technology.

509-81 Edwin F. Johnson, Division Plant Suprvr., Illinois Bell Telephone Co., 6317 Maryland Ave.

510-81 Richard W. Lasko, 234 Littleton, W. Lafayette, Ind., attending Purdue University.

511-81 Walter F. Zielenske, Fire Protection Engineer, Marsh & McLennan, Inc., 231 S. LaSalle St.

513-81 Wallace H. Tyler, Construction Supt., Universal Oil Products Co., 310 S. Michigan Ave.

514-81 William A. Finger, Engineer, Marsh & McLennan, Inc., 231 S. LaSalle St.

515-81 Yoneo Fukudo, 4537 Ellis Ave., attending Illinois Institute of Technology.

516-81 Gordon T. Granert, 1516 E. 69th St., attending Illinois Institute of Technology.

517-81 Joseph P. Jallits, 8726 S. Harper Ave., attending Illinois Institute of Technology.

518-81 Lindley P. Rowe, Chief of Arch'l. Dept., DeLeuw, Cather & Co., 150 N. Wacker Dr.

519-81 Frank Weinberger, 2707 W. Glenlake Ave., attending Illinois Institute of Technology.

520-81 Thomas G. Lehman, Plant Engineer, Illinois Bell Telephone Co., 5643 Broadway Ave.

521-81 Kenneth J. Hlavin, 5311 W. 22nd Pl., Cicero, Ill., attending Illinois Institute of Technology.

522-81 Russel C. Kuhn, 4819 Warner Ave., attending Illinois Institute of Technology.

523-81 Francis M. Collins, Expense Analysis Engineer, Illinois Bell Telephone Co., 208 W. Washington St.

524-81 Donald K. Huber, 147 Jefferson, East Greenville, Pa., attending Northwestern University.

525-81 Gerald K. Seiple, 7546½ Saginaw Ave., attending Northwestern University.

526-81 Glenn S. Shelley, 317 Washington Blvd., Grove City, Pa., attending Northwestern University.

527-81 John L. Rodgers, Jr., 4220 Alden Dr., Minneapolis, Minn., attending Northwestern University.

528-81 Charles Damm, 2615 York St., Blue Island, Ill., attending Northwestern University.

529-81 Collin M. Doyle, Vice President & General Manager, Podbielniak, Inc., 341 E. Ohio St.

530-81 Eugene R. Harkonen, 1119 N. Harding Ave., attending Arkansas State College.

531-81 Wayne E. Jackson, Engineer, Illinois Bell Telephone Company, 6317 S. Maryland Ave.

532-81 Walter C. Kottemann, Engineer, Illinois Bell Telephone Co., 6317 S. Maryland Ave.

533-81 James E. Quinlan, Engineer, Illinois Bell Telephone Co., 6317 S. Maryland Ave.

534-81 A. L. R. Sanders (Rein.), Chief Engineer, Hazelet & Erdal, 53 W. Jackson Blvd.

535-81 William A. Scheller, 1823 Hinman Ave., Evanston, Ill., attending Northwestern University.

536-81 Albert J. Sellergren, Engineer, Illinois Bell Telephone Co., 6317 S. Maryland Ave.

537-81 Franklin C. Senior, Staff Engineer, Freyn Engineering Co., 109 N. Wabash Ave.

538-81 Max L. Clark, Engineer, Illinois Bell Telephone Co., 6317 S. Maryland Ave.

540-81 Mario Pollastrini, Sole Owner, Marty's Italian Restaurant & Cocktail Lounge, 936 Diversey Pkwy.

541-81 Arthur C. Fromm, Vice President & Chief Engineer, The Lloyd-Thomas Co., 4411 Ravenswood Ave.

542-81 William J. Finnegan, Jr., 915 Manchester Ave., Westchester, Ill., attending Northwestern University.

543-81 Melville H. Hodge, Jr., 1703 Chicago Ave., Evanston, attending Northwestern University.

544-81 Louis T. Hooper, 2606 Eastwood Ave., Evanston, attending Northwestern University.

545-81 Stanley C. Killian, Chief Engineer, Delta Star Electric Co., 2400 Fulton St.

546-81 William B. Martin, 226 Sussex Dr., Manhassett, L. I., N. Y., attending Northwestern University.

547-81 Robert F. Miller, 1703 Chicago Ave., Evanston, Ill., attending Northwestern University.

548-81 R. Kenneth Phelps, 1703 Chicago Ave., Evanston, Ill., attending Northwestern University.

549-81 David K. Prugger, 1703 Chicago Ave., Evanston, Ill., attending Northwestern University.

550-81 William H. Schipper, 191-21—35th Ave., Flushing, L. I., N. Y., attending Northwestern University.

551-81 Paul R. Smith, 1421 N. Latrobe Ave., attending Northwestern University.

552-81 Howard W. Snyder, Jr., 2609 E. Jackson Blvd., Elkhart, Ind., attending Northwestern University.

553-81 Irving Suson, 1240 S. Central Park Ave., attending Northwestern University.

554-81 Edward F. Weiss, Plant Engineer, Illinois Bell Telephone Co., 5643 Broadway Ave.

555-81 A. Wm. Whitton, Jr., 1703 Chicago Ave., Evanston, Ill., attending Northwestern University.

556-81 Richard J. Schoenenberger, Chemical Engineer (Sales), Podbielniak, Inc., 341 E. Ohio St.

557-81 Charles I. Brigham, Jr., Plant Engineering Assist., Illinois Bell Telephone Co., 6317 S. Maryland Ave.

558-81 Ray R. Bogdan, Junior Engineer, Dorson Corp., 605 W. Washington Blvd.

559-81 John A. Granath, 4949 Lester Ave., attending Illinois Institute of Technology.

560-81 Thomas J. Karones, 5051 W. Monroe St., attending Illinois Institute of Technology.

561-81 Robert M. Olsen, 5032 Fletcher St., attending Illinois Institute of Technology.

562-81 Constantine P. Sowa, 1529 S. 51st Ave., Cicero, Ill., attending Illinois Institute of Technology.

563-81 John T. Suska, Jr., 5126 S. Maplewood Ave., attending Illinois Institute of Technology.

(To be continued in October Issue)

Reviews of Technical Books

Available at WSE Headquarters

Langmuir on Science

Phenomena, Atoms and Molecules, by Irving Langmuir. Philosophical Library, New York, 1950. 436 pages. $10.00.

In this collection of essays, Dr. Langmuir controverts the accusations that scientists and engineers give no thought to the human and social aspects of their lofty accomplishments. For the first three chapters in the book are philosophical appraisals of science and research, and their relation to human affairs, religion and government. This philosophical vein extends even throughout the remainder of the book, where the subject matter becomes more technical.

Actually, this book is a collection of twenty separate papers selected from about 200 which Dr. Langmuir has written since 1909. The range of topics covered is as diverse as are the achievements of the author, and for this reason plus the well-known authority with which he writes, the book may be best reviewed by a verbatim listing of these topics: science, common sense and decency; discussion of science legislation; world control of atomic energy; surface chemistry; constitution of liquids with special reference to surface tension phenomena; distribution and orientation of molecules; atomic hydrogen as an aid to industrial research; atomic hydrogen; flames of atomic hydrogen; dissociation of hydrogen into atoms; forces near the surfaces of molecules; isomorphism, isosterism and covalence; effects of molecular dissymmetry on properties of matter; metastable atoms and electrons produced by resonance radiation in neon; condensation and evaporation of gas molecules; evaporation, condensation and reflection of molecules and the mechanism of adsorption; evaporation of atoms, ions and electrons from caesium films on tungsten; mobility of caesium atoms adsorbed on tungsten; types of valence.

From this long list of subjects, one is impressed with the contributions which Dr. Langmuir has made to science. From reading his papers in this book, one gathers that he had fun doing it.

W. F. L., WSE.

Radio Handbook

The Radio Amateur's Handbook, by the headquarters staff of the American Radio Relay League, and published by the same organization, 1948. 760 pp. $2.00.

This popular manual, now in its twenty-fifth edition, has been thoroughly revised and considerably enlarged. Several chapters have been added on ultra-short waves and microwaves. Forty-six pages are devoted to a listing of vacuum tubes and their characteristics.

While the handbook is primarily designed for the amateur, it is a convenient and easily understood reference for the engineer.

J. A. S., WSE.

Field Engineering

Field Engineering, by the late William H. Searles and the late Howard Chapin Ives; revised by Philip Kissam. John Wiley and Sons, Inc., New York, 1949. 835 pp. $6.50.

This is the 22nd edition of the well-known handbook first published in 1880. It is made up of two parts: Volume I, 414 pages of text, and Volume II, 421 pages of tables.

Volume I covers the subjects of railroad and highway location, including reconnaissance and preliminary surveys, simple and compound curves, spirals, turnouts and crossings, earthwork, track-laying, instruments, and highway curves. The derivation of all formulae is clearly worked out.

Volume II includes tables of logarithms of numbers and trigonometric functions to six places, natural trigonometric functions to seven places, earthwork, railroad and highway curves, and spirals.

Railroad and highway engineers will find this to be a most useful and valuable book.

H.F.W., WSE.

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RECENT GRADUATE, E.E. Age: 25-30; Either power or electronic option. Knowledge of radio network helpful. Informed about electrical components. Duties: Training program on small transformers. For a manufacturer of transformers. $230. Chicago R-6745.

ASSISTANT CHIEF MECHANICAL ENGINEER, M.E. 30-45; 5 years' exp. req'd. in mechanical design. On automotive controls, weighing machinery or counters. Knowl. of small mechanisms. Informed about production operations. Duties: Assist in supervising design and general engineering on products listed above. Manufacturer of controls. $5000-$8000. Chicago R-6746.

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RESIDENT ENG. OR INSPECTOR, C. E., 33 years old. More than eight years in construction field covering carpentry, concrete and general work in the capacities of foreman, resident engineer, inspector, estimator and expediter. Prefers Chicago. $110. 529-W.

MACHINERY DESIGNER, M.E., 29 years old. Six years' experience drafting, laying out, and designing electrical motors, speed reducers converters, iron and aluminum parts and special equipment. Prefers Chicago. $65. 530-W.

FIELD ENGINEER, C.E., 25 years old. Three years in tunnel work and heavy construction as Chief of Party and Transitman and one year as reinforced concrete and piling inspection. Prefers Chicago area. $4300. 531-W.

ENGINEERING MATHEMATICIAN, M.E., 50 years old. 10 years instructing mechanical engineering, strength of materials, fluid flow, and heat transfer. Some practical experience in calculations for steel mills and equipment. Prefers Chicago. $8000. 532-W.

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